Positive and negative sequence currents to improve voltages during unbalanced faults

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1 Variable resistance/inductance ratio

In this section we try to answer to the question of what happens when the R/X ratio varies. This way we experiment with cases where the resistive part is considerably larger than in the aforementioned anlysis. The fault impedance $\underline{Z}_f$ has been set at 0.1, which is probably more realistic than $0.0 + 0.1j$.

1.1 Balanced fault

Figure 1 depicts the optimal currents for the balanced fault.

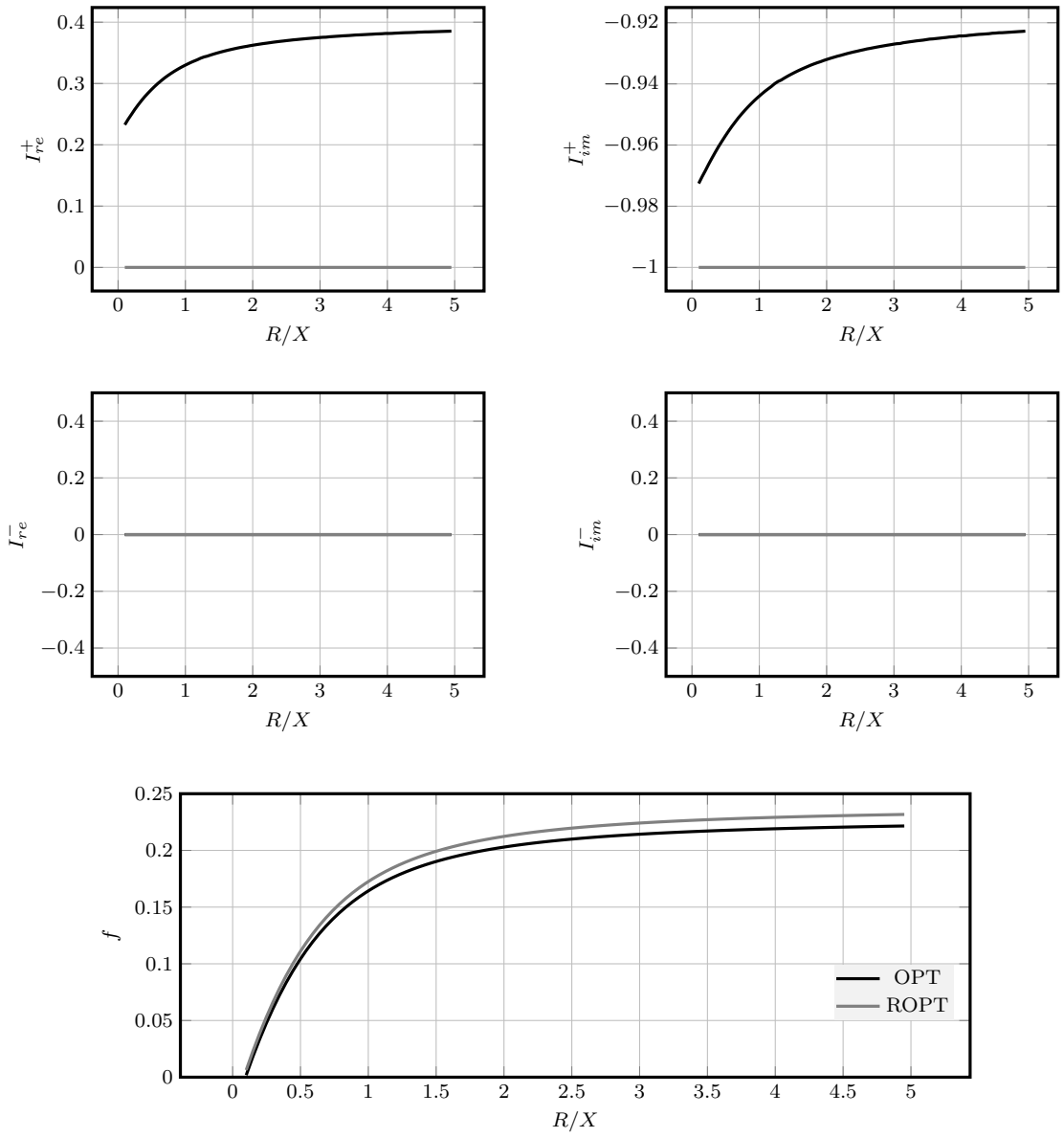

Figure 1: Influence of the currents on the objective function for the balanced fault and a changing R/X ratio. OPT: solution to the optimization problem, ROPT: solution to the optimization problem restricted to only injecting reactive power.

1.2 Line to ground fault

Figure 2 depicts the optimal currents for the line to ground fault.

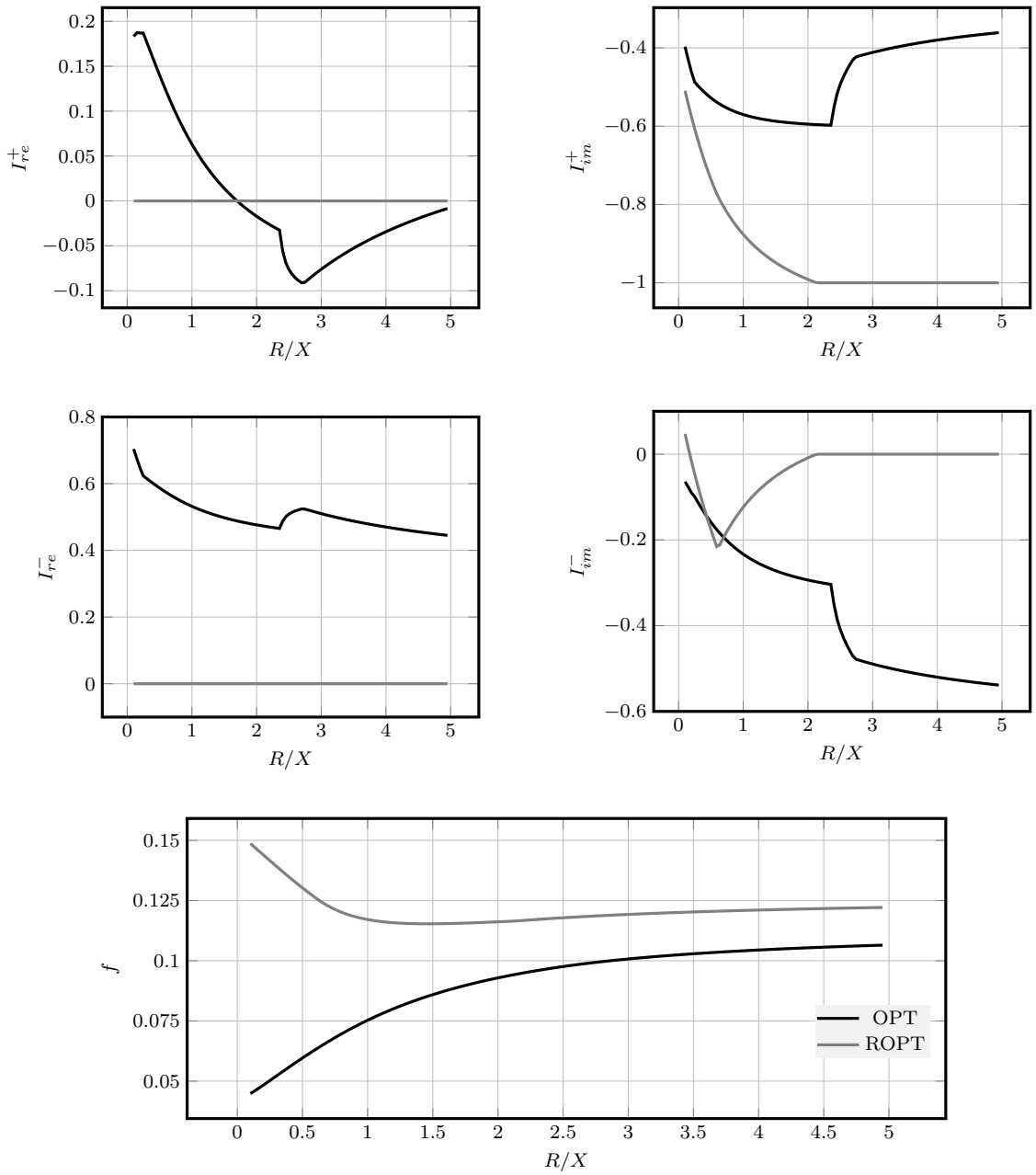

Figure 2: Influence of the currents on the objective function for the line to ground fault and a changing R/X ratio. OPT: solution to the optimization problem, ROPT: solution to the optimization problem restricted to only injecting reactive power.

1.3 Line to line fault

Figure 3 depicts the optimal currents for the line to line fault.

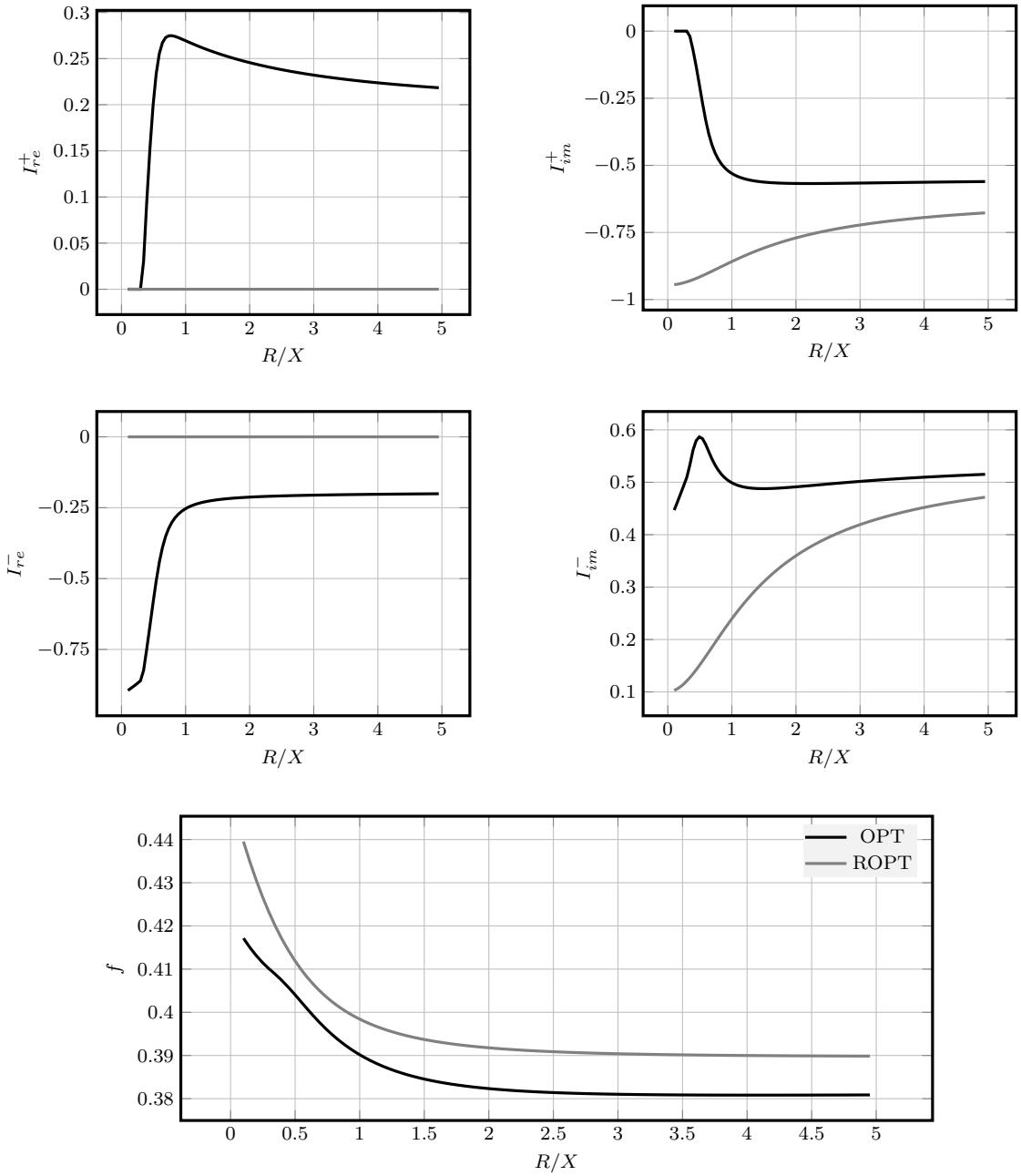

Figure 3: Influence of the currents on the objective function for the line to line fault and a changing R/X ratio. OPT: solution to the optimization problem, ROPT: solution to the optimization problem restricted to only injecting reactive power.

1.4 Double line to ground fault

Figure 4 depicts the optimal currents for the balanced fault.

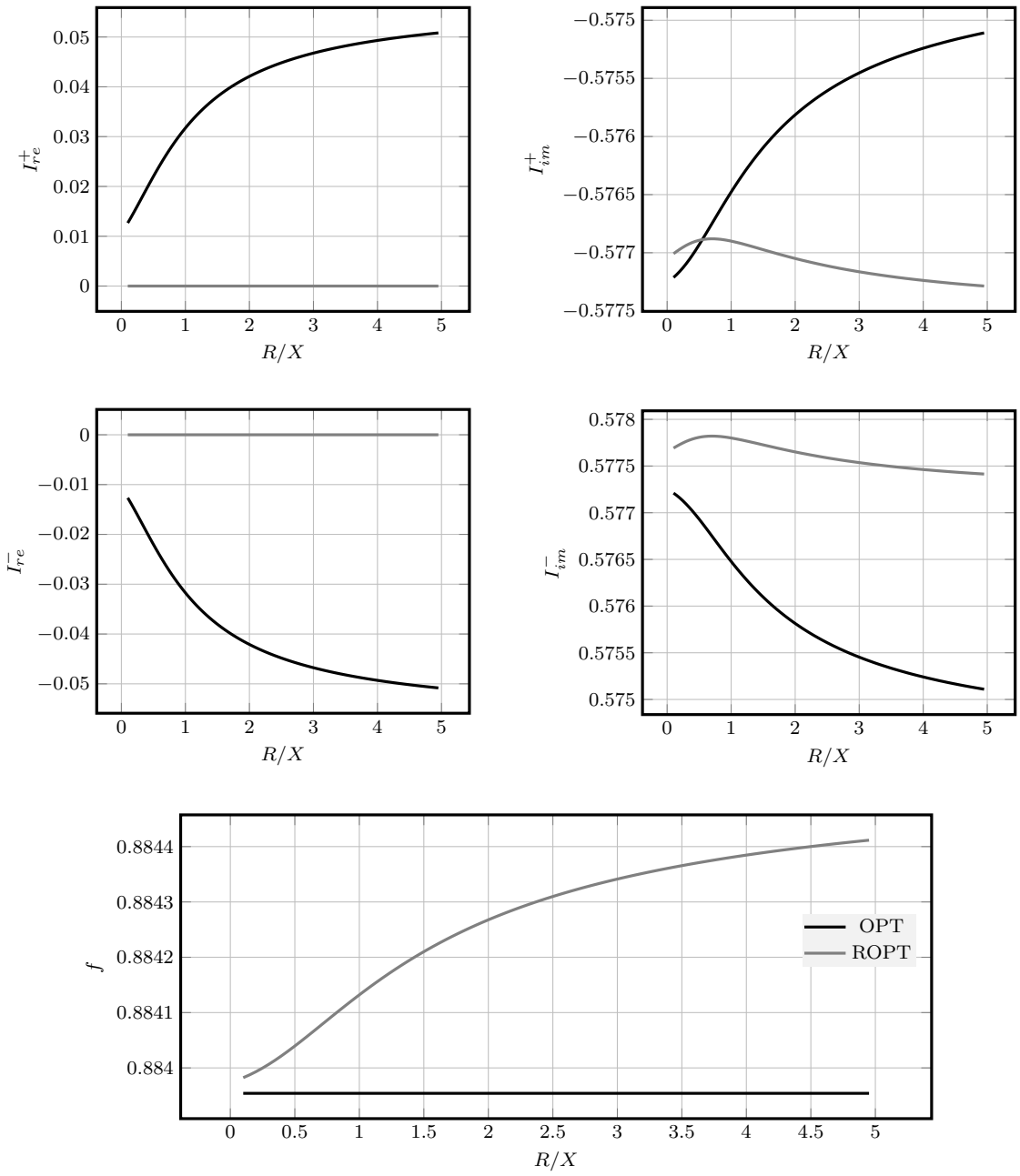

Figure 4: Influence of the currents on the objective function for the double line to ground fault and a changing R/X ratio. OPT: solution to the optimization problem, ROPT: solution to the optimization problem restricted to only injecting reactive power.

2 Submarine cable

We now deal with a submarine cable, which is modelled with a π equivalent, where the series impedance is still $\underline{Z}_a$ while the parallel impedance is $\underline{Z}_c = -jX_c$. As follows, we sweep across X_c.

2.1 Balanced fault

Figure 5 depicts the optimal currents for the balanced fault.

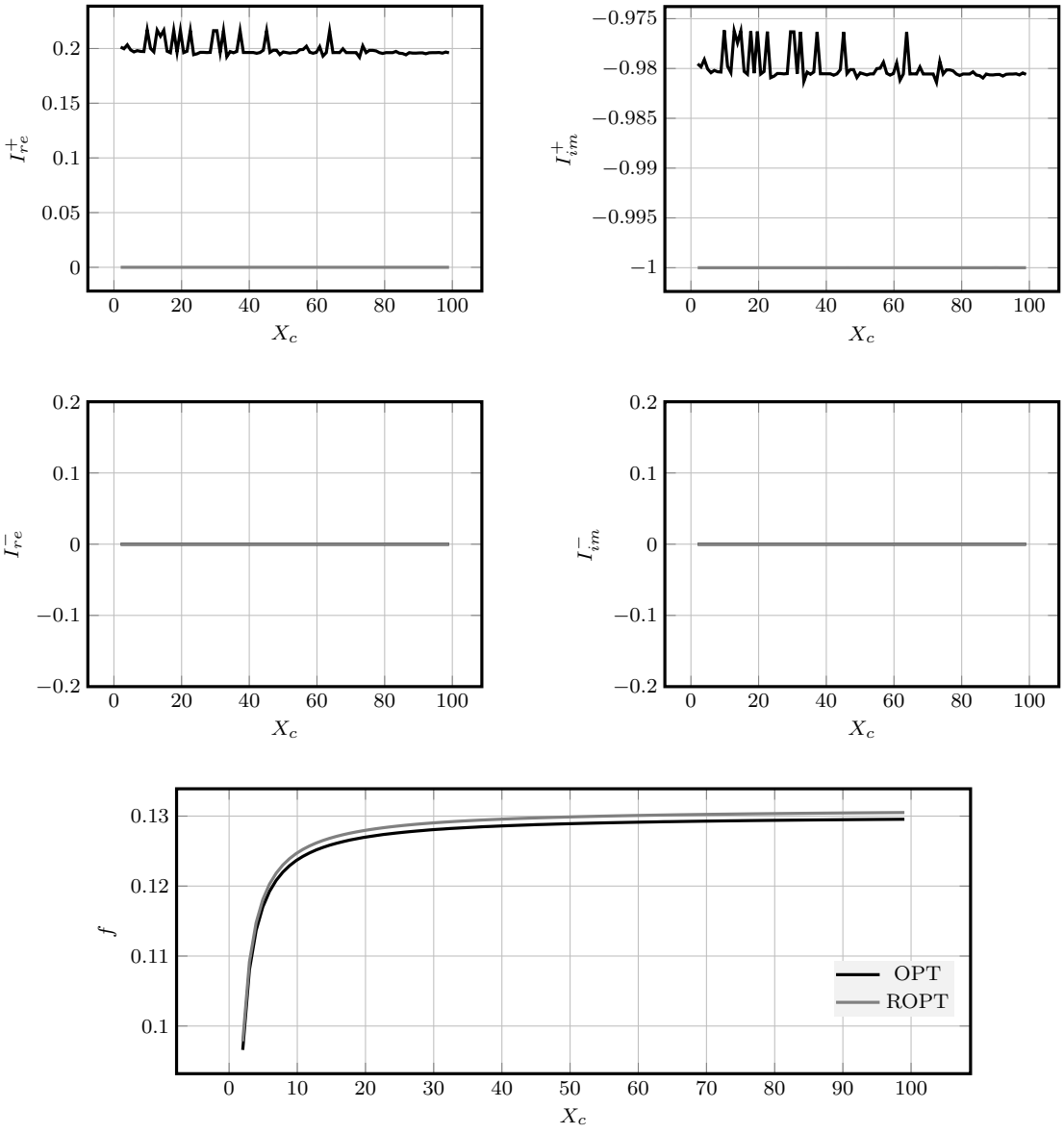

Figure 5: Influence of the currents on the objective function for the balanced fault and a submarine cable. OPT: solution to the optimization problem, ROPT: solution to the optimization problem restricted to only injecting reactive power.

2.2 Line to ground fault

Figure 6 depicts the optimal currents for the line to ground fault.

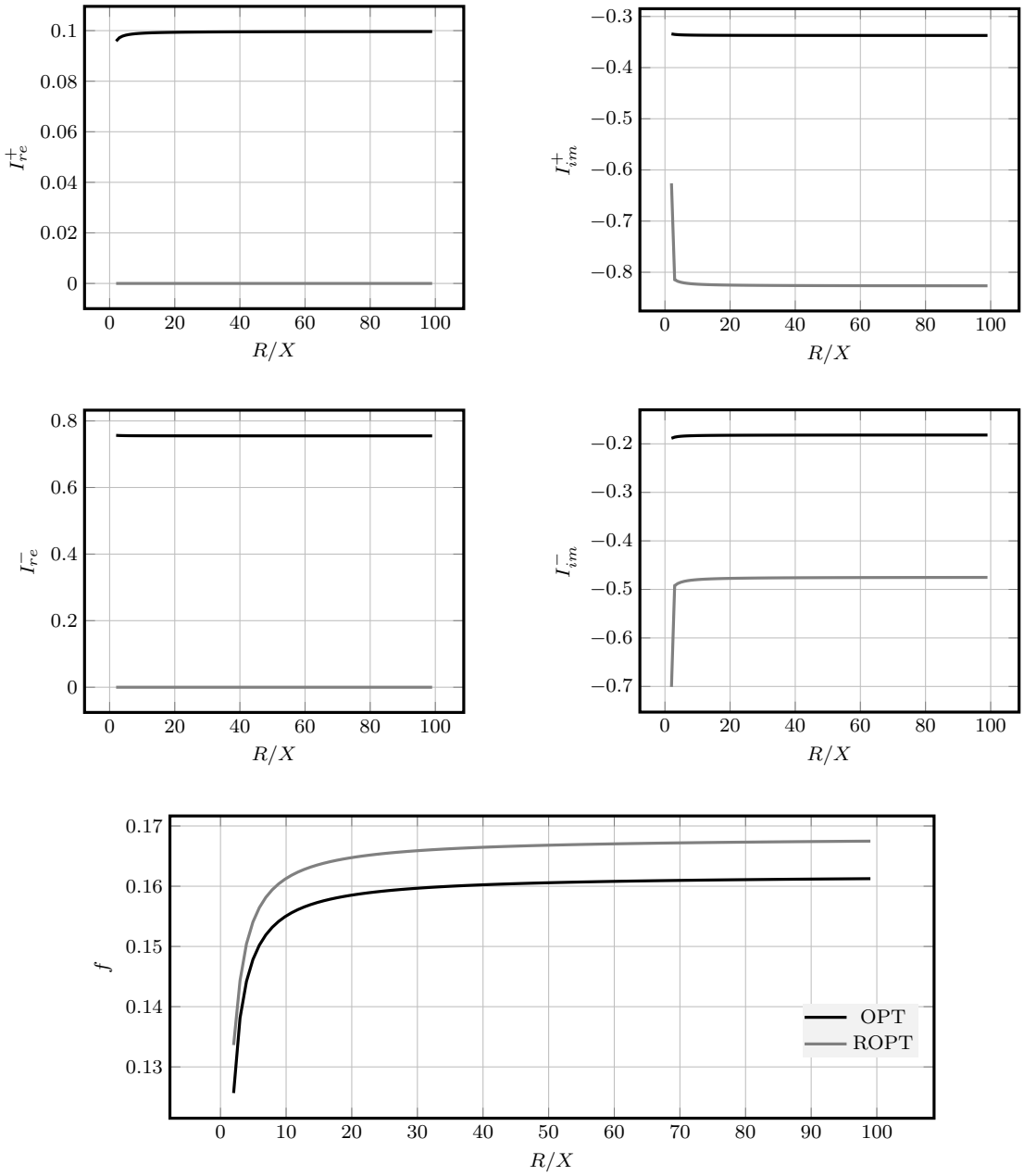

Figure 6: Influence of the currents on the objective function for the line to ground fault and a submarine cable. OPT: solution to the optimization problem, ROPT: solution to the optimization problem restricted to only injecting reactive power.

2.3 Line to line fault

Figure 7 depicts the optimal currents for the line to line fault.

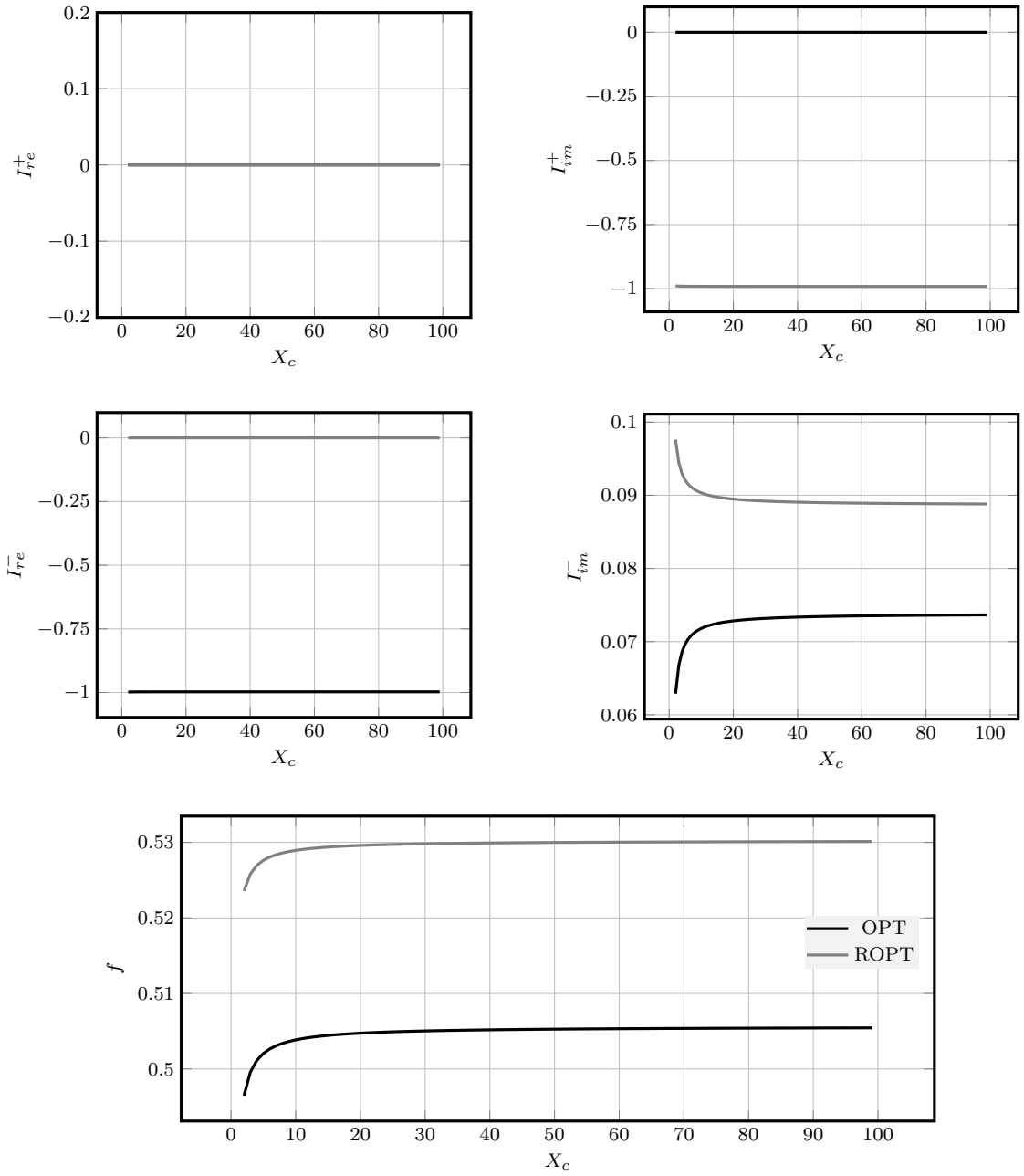

Figure 7: Influence of the currents on the objective function for the line to line fault and a submarine cable. OPT: solution to the optimization problem, ROPT: solution to the optimization problem restricted to only injecting reactive power.

2.4 Double line to ground fault

Figure 8 depicts the optimal currents for the balanced fault.

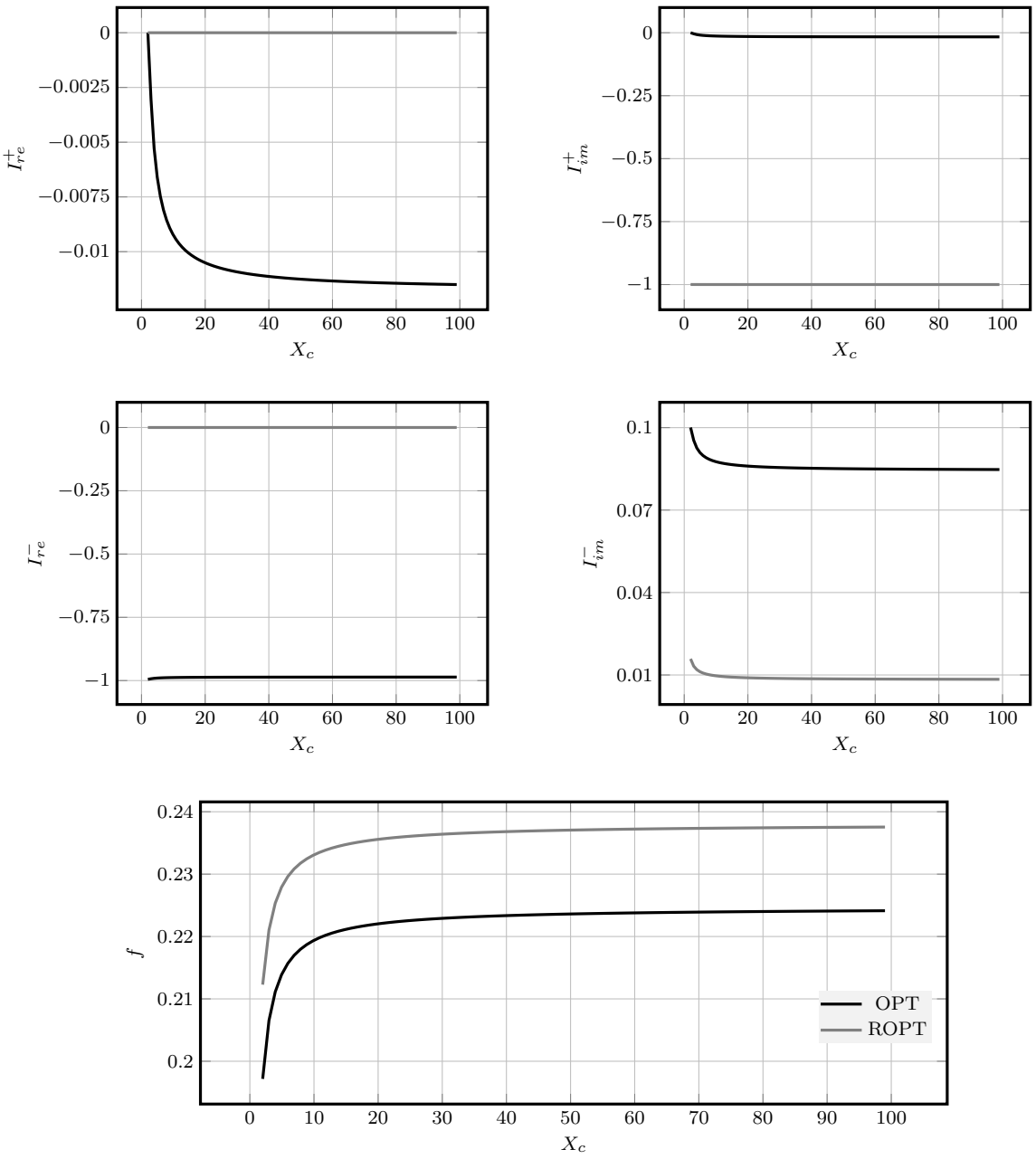

Figure 8: Influence of the currents on the objective function for the double line to ground fault and a submarine cable. OPT: solution to the optimization problem, ROPT: solution to the optimization problem restricted to only injecting reactive power.